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**Trimming More Than Just the Fat
Utilizing a Requirements Integration and Prioritization Process
(RIPP) to Guide the Blade**



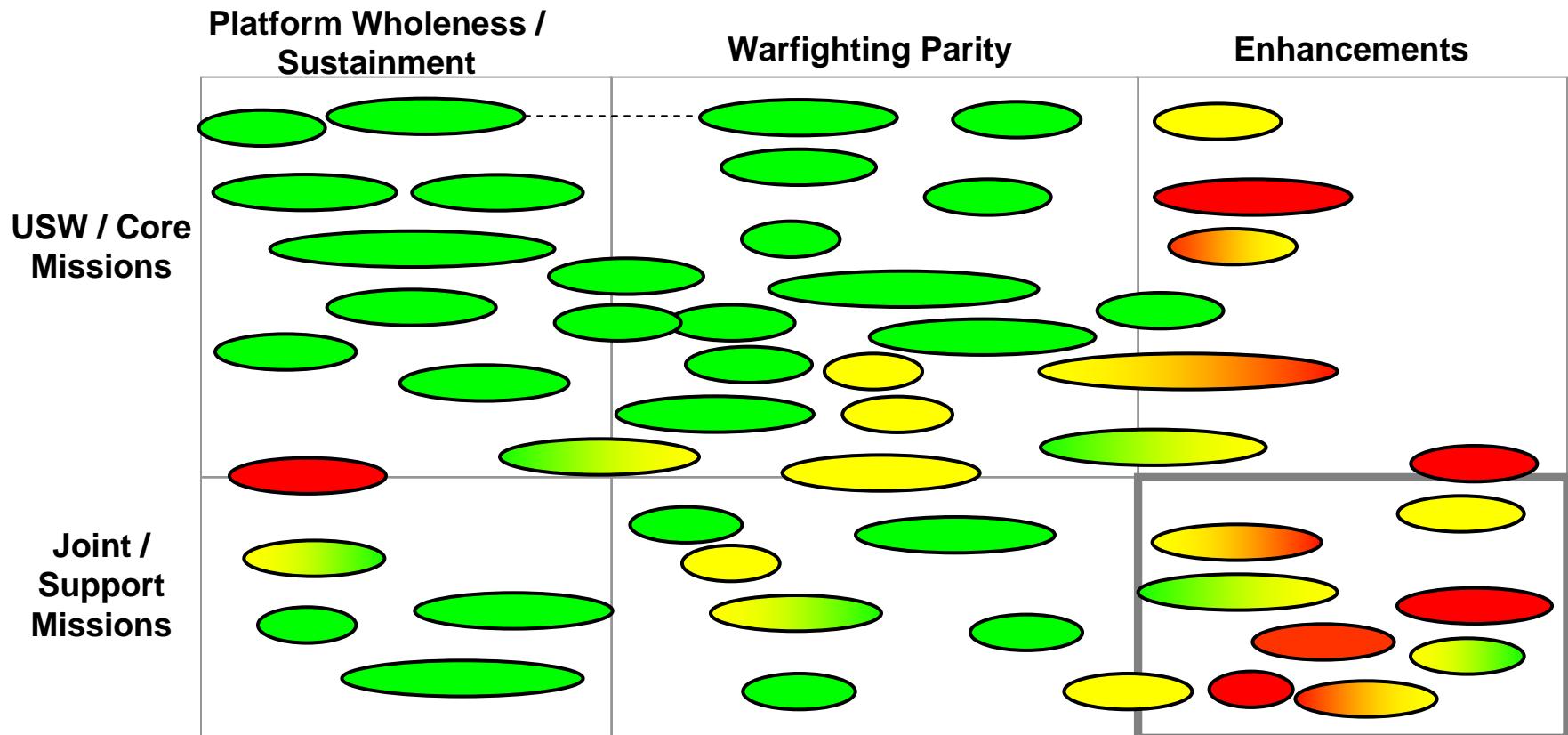
Requirements Integration and Prioritization Process

- **Problem**
 - Aid the Undersea Enterprise Resource Sponsor (OPNAV) in prioritizing for the Program Objective Memorandum or Program Review builds
 - Maintain current capability and readiness
 - Enhance future submarine force capability
- **Environment**
 - Stable or reduced budget authority
 - Rising costs
 - Personnel
 - Commodities
 - Meet customer demand signal
- **Result:** *Look for programs / mission areas to divest*



Current Assessment Methods

- SME based - Too many factors to hold in one's head?
- Rank 1 to n - Problems with ordinal based comparisons
- Stoplight charts





A Form of Wicked Problem?

- Some attributes in common with wicked problems (from Rittel and Webber, 1973):
 - Wicked problems do not have an exhaustive set of potential solutions.
 - Every wicked problem is essentially unique--lessons-learned are hard to transfer across to other problems.
 - Wicked problems are often "solved" (as well as they can be...) through group efforts.
 - Every implemented solution to a wicked problem has consequences, and may cause additional problems.
 - Wicked problems have no stopping rule(s).
 - Solutions to wicked problems are not true-or-false, but instead better, worse, or good enough.
 - There is no immediate and no ultimate test of a solution to a wicked problem.
 - The planner or designer (solving the problem) has no inherent right to solve the problem, and no permission to make mistakes.
- Also has aspects of Multi-Attribute Utility and Systems Thinking



Goals For Requirements Integration and Prioritization Process

- Make better decisions
 - Fidelity
 - Traceability
 - Repeatability
 - Transparency
- Limited resources
 - Two (now one) person shop
 - No budget

Avoid This →





Requirements Integration and Prioritization Process

Phase 1 – Needs Analysis

(Identify Gaps and SWOTs vs. Functional Area)

Phase 2 – Alternatives Analysis

(Programs effects on Functional Areas)

Phase 3 – Cost-Effectiveness Analysis

(Cost, Marginal Cost, Marginal Need, Marginal Effectiveness, Cost Effectiveness Ratio)

Phase 4 – Risk Analysis

(Risk Score)



Requirements Integration and Prioritization

Need Analysis:

- Process of identifying and evaluating needs in a defined population of people. The identification of needs is a process of describing “problems” of a target population. A need has been described as:
- A GAP between “what is” and “what should be.” (Witkin et al., 1995)
- “A GAP between real and ideal that is both acknowledged by community values and potentially amenable to change.” (Reviere, 1996, p. 5)
- May be different from such related concepts as wants (“something people are willing to pay for”) or demands (“something people are willing to march for”). (McKillip, 1987)

For assessment purposes, GAPs are the primary factor guiding decisions to invest in, or divest from a capability.

SWOTs (strengths, weaknesses, opportunities, and threats) are used as a decision aid (i.e., if weaknesses and threats outweigh strengths and opportunities, then a decision to divest is supported, and vice versa if strengths and opportunities outweigh threats and weaknesses).



Steps of a Needs Analysis for GAPs

1. Determine who benefits from the needs analysis, i.e. uses for, and users of it
2. Determine the USE relevant GAPs that exist because a capability is not sufficient or does not exist – focus should be on the primary recipient (i.e., user of the capability vice producer of the capability – USE, CUSFFC, CNO, COCOM) and capabilities identified for a specific scenario (i.e., MCO-x, GWOT); GAPs are generally identified by the Fleet Operational Agents (OAs) or by COCOM Integrated Priority Lists (IPLs) and direct messages
3. For each functional area, rate the level to which USE capabilities can close the GAP; Tier 1 Functional areas are the highest level of Navy Tasks (NTA), Tier II and beyond are Navy Mission Essential Tasks (NMET) required to perform the Tier 1 NTA (See Back-up slide)
4. Take the sum of the averages of the ratings for across the GAPs and divide it by the number of non-N/A entries to get the mean of the ratings for each functional area
5. Conduct a SWOT (strengths, weaknesses, opportunities, threats) analysis to identify if there is value-added for developing/continuing to develop a capability within a functional area. Compute the average of the Strengths and Opportunities, and the average of the Weaknesses and Threats for each functional area. With SWOT Analysis, the case for capability investment is when Strengths and Opportunities outweigh Weaknesses and Threats, and vice versa for divestment
6. Communicate results of needs assessment to users identified in the first step



Needs Analysis - Step 3

Determine the rating for the GAPs (defined by the USE, USFFC, CNO, COCOM(s), or Others) for which the USE has capabilities within Functional Areas, defined as the highest level of Navy Tasks, to fill or help fill.

SCENARIO – MCO-x

FUNCTIONAL AREA	GAP 1					GAP 2					GAP n				
	USE	FFC	CNO	COCOM	OTHER	USE	FFC	CNO	COCOM	OTHER	USE	FFC	CNO	COCOM	OTHER
INTEL, SURV, RECON	X	X	X	X	X	N/A	X	X	N/A	X	X	X	X	X	X
COMMAND & CONTROL															
PROTECTION	X	X	X	X	X	N/A	N/A	N/A	N/A	N/A	X	X	X	X	X
AREA XXX															

Rating Scale:

N/A – USE has no capability in the functional area

1 – has no ability to fill the gap

2 – has some ability to fill the gap

3 – has a lot of ability to fill the gap



Needs Analysis - Step 4

What is the mean rating (G) for the USE's ability to fill GAPs within each Functional Area?

SCENARIO – MCO-x

FUNCTIONAL AREA	GAP 1					GAP 2					GAP n					
	USE	FFC	CNO	COCOM	OTHER	USE	FFC	CNO	COCOM	OTHER	USE	FFC	CNO	COCOM	OTHER	
INTEL, SURV, RECON	3	1	1	3	2			1	2		3	3	1	1	3	2
COMMAND & CONTROL																
PROTECTION																
AREA XXX																

$G_{FA\ 1...n} = (\text{Sum of non-N/A GAP Ratings} / \text{No. non-N/A entries})$ for each Functional Area, i.e. --

$$G_{ISR} = 26 / 13 = 2.0$$



Needs Analysis - Step 5

SWOT Analysis -- Are there are reasons to: 1) develop a capability other than to fill a GAP(s), i.e. emerging threat(s) for FYDP/beyond FYDP programs; 2) kill a program that no longer meets future capability needs?

FUNCTIONAL AREA	SWOT Assessment / MCO-x			
	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
INTEL, SURV, RECON	3	1	2	1
COMMAND & CONTROL				
PROTECTION				
AREA XXX				

Rating Scale:

STRENGTHS (S) per Functional Area

- 1 – Have potential to be capability provider
- 2 – Have little competition as capability provider
- 3 – Known to be best capability provider

WEAKNESSES (W) per Functional Area

- 1 – Plans/funds exist to develop capability
- 2 – Plans/funds to develop capability not timely
- 3 – Plans/funds do no exist to develop capability

OPPORTUNITIES (O) per Functional Area

- 1 – No events to demo as capability provider
- 2 – Scheduled demos as capability provider
- 3 – Demonstrating ability to provide capability

THREATS (T) per Functional Area (military vice business)

- 1 – I&W suggest strong need for capability
- 2 – I&W suggest possible need for capability
- 3 – I&W suggest no need for capability



Needs Analysis - Step 5 con't.

What is the average of the ratings for Strengths and Opportunities, and for Weaknesses and Threats (used to support decisions for investing in, or divesting from capabilities) within each Functional Area?

SWOT Assessment / MCO-x				
FUNCTIONAL AREA	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
INTEL, SURV, RECON	3	1	2	1
COMMAND & CONTROL				
PROTECTION				
AREA XXX				

$$\text{Persistent ISR}_{(S\&O)} = (S + O) / 2 = 5 / 2 = 2.5$$

$$\text{Persistent ISR}_{(W\&T)} = (W + T) / 2 = 2 / 2 = 1.0$$

With SWOT Analysis, the case for capability investment is when Strengths and Opportunities outweigh Weaknesses and Threats, and vice versa for divestment. In the case of Persistent ISR, the ratings indicate there is reason to consider investing in capabilities to support this Functional Area.

$$\text{Persistent ISR}_{(S\&O)} - \text{Persistent ISR}_{(W\&T)} = 2.5 - 1.0 = 1.5$$

Since the difference is positive, there is reason to consider investing in capabilities to support this Functional Area.



Steps of a Alternative(s) Analysis

- 1. Determine who benefits from the alternative(s) analysis, i.e. uses for, and users of it**
- 2. Evaluate the capability impact within a functional area for each identified potential alternative to address SWOTs and Gaps**
- 3. Evaluate the average capability impact across all functional areas for each identified potential alternative**
- 4. Communicate results of alternative(s) analysis to users identified in the first step of the needs assessment**



Alternative(s) Analysis - Step 2

Within the context of a particular Defense Planning Scenario (DPS), how useful (U) is a potential alternative (PA) in providing capability(ies) to functional areas?

Potential Alternative (PA) Assessment per Functional Area -- MCO-x

FUNCTIONAL AREA	PA1 = CSD	PA2 = SCJC2	PAn = UAV
INTEL, SURV, RECON	3		
COMMAND & CONTROL		2	
PROTECTION			
AREA XXX			

Rating scale: U = N/A – USE has no capability in the functional area
1 – has no ability to fill the gap
2 – has some ability to fill the gap
3 – has a significant ability to fill the gap



Alternative(s) Analysis - Step 2, con't.

Within the context of a particular DPS, determine value-added (VA) for a potential alternative (PA) (i.e., CSD, SCJC2, UAV, etc.) across all functional areas.

Potential Alternative (PA) Assessment per Functional Area -- MCO-x

FUNCTIONAL

AREA	PA1 = CSD	PA2 = SCJC2	PAn = UAV
INTEL, SURV, RECON	$(VA)_{C@SD, PISR} = (G + (S+O)/2 - (W+T)/2) + U$		
COMMAND & CONTROL		$(VA)_{SCJC2, PGS} = (G + (S+O)/2 - (W+T)/2) + U$	
PROTECTION			
AREA XXX			

$$(VA)_{PA1...n} = ((\sum_{FA1...n} (G + (S+O)/2 - (W+T)/2) + U) / \text{No. of Functional Areas to which the PA contributes})$$

For example, if U is high, and averages of S & O are high, W & T are low, and GAPs are high, then decision should be invest In capability; If U is low, and averages of S & O are low, W & T are high, and GAPs are low, then decision should be divest from capability.



Alternative(s) Analysis - Step 3

Within the context of a particular DPS, determine value-added (VA) for a potential alternative (PA) (i.e., C@SD, SCJC2, UAV, etc.) across all functional areas.

Potential Alternative (PA) Assessment per Functional Area -- MCO-x

FUNCTIONAL

AREA	PA1 = CSD	PA2 = SCJC2	PAn = UAV
INTEL, SURV, RECON	$(VA)_{C@SD, PISR} = (G + (S+O)/2 - (W+T)/2) + U$		
COMMAND & CONTROL		$(VA)_{SCJC2, PGS} = (G + (S+O)/2 - (W+T)/2) + U$	
PROTECTION			
AREA XXX			

$$\overline{(VA)}_{PA1...n} = ((\sum_{FA 1...n} (G + (S+O)/2 - (W+T)/2) + U) / 1)$$

The average value-added score for C@SD is determined by summing the VA score in each functional area where C@SD is a supporting capability, and dividing it by the number of functional areas contributing to the sum.

$$(VA)_{MCO,C@SD, \text{ ALL FUNCTIONAL AREAS}} = (2 + (2.5 - 1.0) + 3) / 1 = 6.5$$



COST EFFECTIVENESS ANALYSIS

- Obtain detailed cost information on all resources allocated
- Link resources allocated to the objectives, goals, desired end-states, etc. at higher echelons
- Ranked order set of priorities for each of the objectives, goals, desired end-states, etc. to assign an effectiveness or value-added score – value-based decision-making
- Evidence-based evaluation criteria to determine value-added of resource throughout life-cycle management phases



Cost Effectiveness Ratio

- Sum of all Costs divided by the Sum of all Benefits, or
- The Ratio of Cost Difference between Pairs of Alternatives divided by the difference in Effect(s) Achieved between Pairs of Alternatives --

$$\frac{\text{Cost (Alternative A)} - \text{Cost (Alternative B)}}{\text{Value Added (Alternative A)} - \text{Value Added (Alternative B)}}$$

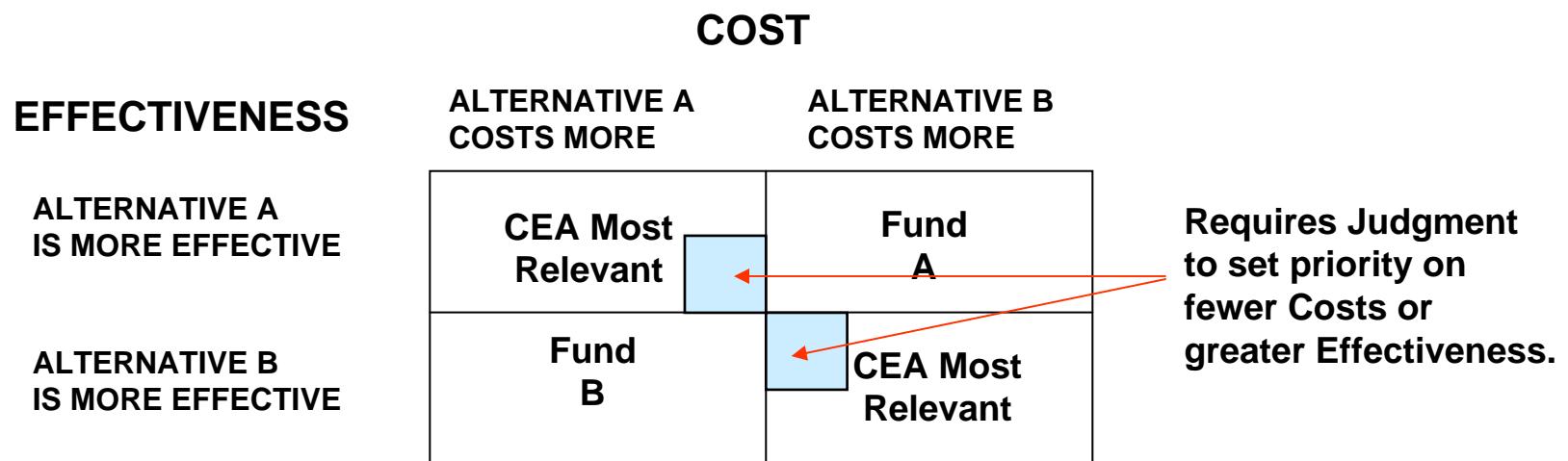
- Benefits not measured in terms of costs alone, as in a return on investment (ROI) calculation - evaluation is based on a combination of outcomes and costs
- Cost-effectiveness does not always mean saving money – its about gaining more effectiveness (productivity) for costs expended



Marginal Cost

Difference between cost of a paying for an alternative and doing nothing (remaining status quo), or paying for another alternative; calculation also applies to effectiveness ...

So the real relevance for the Cost Effectiveness (CE) Analysis for making resource allocation decisions applies only if the cost of one alternative is both more effective and more costly, OR is both less effective and less costly, unless ranges of acceptable effectiveness and costs are set.





Marginal Need

Marginal Need (MN) = Value Added Calculation from Need:

Difference between capability provided by a potential alternative and doing nothing (status quo), or capability provided by another potential alternative (degree of closure), PLUS the average SWOT analysis score.

So the real relevance for the Needs Assessment for supporting resource allocation decisions applies only if the capability of one alternative is more effective towards closing a GAP than another; Trade-offs between needs, costs, and effectiveness occur in the third phase of the RIP process.

FUNCTIONAL AREAS	Potential Alternatives -- MCO-x GAPs			
	PA1	PA2	PA3	PAn
INTEL, SURV, RECON	$MN_{MCO,FA1,PA1}$			
COMMAND & CONTROL		$MN_{MCO,FA2,PA2}$		
PROTECTION				
AREA XXX				



Cost Effectiveness Ratio – Utilization

Decisions for allocating resources to one alternative over another alternative are ultimately based on the ratio of Marginal Cost to Marginal Effectiveness. (Again, the cost of the ‘Do Nothing’ option is actually the cost of remaining status quo.)

Example:

STRATEGY	COST	MARGINAL COST	MARGINAL NEED BY SCENARIO	MARGINAL EFFECTIVENESS	CE RATIO (MARGINAL COST / MARGINAL EFFECT)
DO NOTHING / STATUS QUO	\$ 0.00	N/A	N/A	N/A	N/A
ALTERNATIVE A	\$ 5.75 M	\$ 5.75 M	MN _{SCEN,EA1,PA1} = 4	4	$5.75 / 4 = 1.44$
ALTERNATIVE B	\$ 9.50 M	\$ 3.75 M	MN _{SCEN,EA2,PA2} = 5	1	$3.75 / 1 = 3.75$

SUPPORTS USING UNLIKE PERFORMANCE CRITERIA TO ASSIGN EFFECTIVENESS SCORE

DECISION SHOULD FAVOR ALTERNATIVE A – RESULTS IN MORE “BANG FOR THE BUCK”



Cost Effectiveness Ratio – Utilization

Decisions for divesting of current investments are also based on the ratio of Marginal Cost to Marginal Effectiveness.

Example:

STRATEGY	COST	MARGINAL COST	EFFECTIVENESS / VALUE ADDED SCORE	MARGINAL EFFECTIVENESS	CE RATIO (MARGINAL COST / MARGINAL EFFECT)
DO NOTHING	\$ 0.00	N/A	0	N/A	N/A
CURRENT PROGRAM	\$ 5.75 M	\$ 5.75 M	4	4	$5.75/4 = 1.44$
NEW PROGRAM	\$ 8.75 M	\$ 3.00 M	3	3	$3.00/3 = 1.00$

DECISION SHOULD FAVOR OF DIVESTING OF CURRENT PROGRAM
AND ALLOCATING RESOURCES FOR THE NEW PROGRAM



Risk Analysis

- Examine the resulting decisions that are made
- Determine if risk to supported commands (customers) is too high
- Multiple levels of risk (for each customer
 - National
 - Naval
 - Enterprise
- Many dimensional look at risk
- Application of this not yet developed



Risk Analysis

National Requirement Demand Signal

NS1 = NATIONAL STRATEGY – COCOM IPL

RISK AREA IMPORTANCE –
10 = HIGH, 5 = MEDIUM, 1 = LOW, 0 = N/A

MAXIMUM SCORE
POSSIBLE, I.E.
ELEVEN AREAS X
SCORE OF 10 EACH

NS1

A	B	C	D	E	F	G	H	I	J	K	Σ	$\Sigma /110$

RISK
SCORE
(RS)

- A - COCOM REQUIREMENT NOT MET
- B - SUBMARINER SAFETY NOT PROVIDED
- C - DOES NOT COMPLY WITH NAVY DIRECTIVE
- D - IMPACTS ABILITY TO ACHIEVE OP. AVAIL.
- E - QUALITY OF LIFE DEGRADED
- F - WARFIGHTER DEMAND NOT MET - MUA
- G - INTERRUPTS ACQUISITION CYCLE
- H - IMPACTS INDUSTRIAL BASE
- I - CREATES TECHNOLOGY GAP
- J - CONTRACT NON-COMPLIANCE
- K - IMPACTS STAKEHOLDER(S) CAPABILITY

RISK
AREAS



Risk Analysis

Naval Requirement Demand Signal

CNO NAVY STRATEGIC PLAN

CN1 = ACCEPT MORE RISK IN XXX CAPABILITY

CN2 = REDUCE RISK IN ASW FOR YYY

CN3 = REDUCE RISK IN LOCATE, TRACK, & TARGET THREAT; DISRUPT/ATTACK ZZZ CAPABILITIES

RISK AREAS

- A - COCOM REQUIREMENT NOT MET
- B - SUBMARINER SAFETY NOT PROVIDED
- C - DOES NOT COMPLY WITH NAVY DIRECTIVE
- D - IMPACTS ABILITY TO ACHIEVE OP. AVAIL.
- E - QUALITY OF LIFE DEGRADED
- F - WARFIGHTER DEMAND NOT MET - MUA
- G - INTERRUPTS ACQUISITION CYCLE
- H - IMPACTS INDUSTRIAL BASE
- I - CREATES TECHNOLOGY GAP
- J - CONTRACT NON-COMPLIANCE
- K - IMPACTS STAKEHOLDER(S) CAPABILITY

RISK AREA IMPORTANCE –
10 = HIGH, 5 = MEDIUM, 1 = LOW, 0 = N/A

	A	B	C	D	E	F	G	H	I	J	K	Σ	Σ /110	RISK SCORE (RS)
CN1														
CN2														
CN3														



Risk Analysis

Undersea Requirement Demand Signal

Also considered
Effects to Achieve

COMSUBFOR

US1 = BASIC SUBMARINE OPS

US2 = 21ST CENTURY LEADERS

US3 = FUTURE CAPABILITY

US4 = PERSISTENT PRESENCE

US5 = STEALTH

RISK AREAS

- A - COCOM REQUIREMENT NOT MET
- B - SUBMARINER SAFETY NOT PROVIDED
- C - DOES NOT COMPLY WITH NAVY DIRECTIVE
- D - IMPACTS ABILITY TO ACHIEVE OP. AVAIL.
- E - QUALITY OF LIFE DEGRADED
- F - WARFIGHTER DEMAND NOT MET - MUA
- G - INTERRUPTS ACQUISITION CYCLE
- H - IMPACTS INDUSTRIAL BASE
- I - CREATES TECHNOLOGY GAP
- J - CONTRACT NON-COMPLIANCE
- K - IMPACTS STAKEHOLDER(S) CAPABILITY

Potential Additions

RISK AREA IMPORTANCE –
10 = HIGH, 5 = MEDIUM, 1 = LOW, 0 = N/A

	A	B	C	D	E	F	G	H	I	J	K	Σ	RISK SCORE (RS)
US1													
US2													
US3													
US4													
US5													



Requirements Integration and Prioritization

- Attempt to provide traceability and transparency to divestment recommendations
- Multiphased
 - Needs Analysis
 - Alternatives Analysis
 - Cost-Effectiveness Analysis
 - Risk Analysis
- Process not fully matured
- Testing during POM-10





Submarine Tactical Task List

Maneuver		ISR	Firepower	Support	C2	Protect
1.1.1.7.3 Provide DC	1.3.1.1 Conduct Mine Hunting*	2.2 Collect Data and Intelligence	3.1.5 Tactical Combat Assessment	4.1.5 Ordnance Handling	5.1.1 Communicate Information	6.1.1.3 Identify Friendly Forces
1.1.2.3 Move Units	1.3.2.3 Transit Mine Danger Area	2.2.1 Collect Target Information	3.1.7 Employ Counter-Targeting	4.9.1 Conduct Mission Area Training	5.2.11 Review and Evaluate Situation	6.1.2.1 Employ Operations Security
1.1.2.3.1 Sail Ship from Port	1.4.1 Conduct Mining*	2.2.2 Collect Tactical Intelligence	3.2.1.1 Attack Surface Targets	4.9.2 Assess Training	5.2.1.2 Review / Evaluate Msn Guidance	6.1.2.1.2 Concealment Techniques
1.1.2.3.2 Return Ship to Port	1.4.5 Conduct Blockade	2.2.3.1 Search Assigned Areas	3.2.1.2 Attack Submerged Targets		5.2.2 Decide on Need for Action/Change	6.2.1 Evacuate Noncombatants from Area
1.1.2.3.8 Submerged Ops	1.4.6 Conduct Maritime Interception	2.2.3.2 Perform Tactical Recon	3.2.2 Attack Enemy Land Targets		5.3 Determine & Plan Actions & Ops	6.2.3 Rescue in Non-Hostile Environment
1.1.2.4 Tactical Insertion & Extraction	1.4.7 Enforce Exclusion Zone	2.2.4 Assess Tactical Environment	3.2.5 Conduct Electronic Attack*		5.4.5 Analyze Mission Readiness	6.2.4 Combat Search and Rescue (CSAR)
1.2.7 Tactical Oceanographic Analysis	1.4.8.2 Counter Drug Operations	2.4.5.3 Provide I & W of Threat	3.2.6 Interdict Enemy Forces / Targets		5.5.4 Conduct Electronic Support	6.2.6 Submarine Escape and Survival
1.2.8 Tactical Recon and Surveillance	1.5.7 Conduct Naval Special Warfare		3.2.10 Integrate Tactical Fires		5.5.5 Perform Information Assurance	6.3.1.5 Enforce Protection of Perimeter
1.2.1.1 Conduct Navigation		* Note: Generated capability	3.3 Special Weapons Attack (SSBN)			6.6 Operational Safety of Pers and Equipment